

## **Test Article Construction and Insulation Observation Notes**

The following notes were recorded by F. Wyant, Sandia National Laboratories, during his observation of activities at the Omega Point Laboratories facilities over the period of March 4<sup>th</sup> through March 25<sup>th</sup>. The daily observations were originally communicated via e-mail messages sent from OPL to SNL and to the NRC staff. These observations have been compiled here for convenience and for inclusion in the test program documentation.

Note that, in the interest of completeness, the daily record has been supplemented beyond the original e-mail messages to reflect activities undertaken on the following specific days:

- Thursday March 10 and Friday March 11 (testing of Test Article #1),
- Monday March 14 through Thursday March 17 (activities focused at Promatec), and
- Friday March 25 (testing of Test Article #2)

Beyond this, the daily observations are exactly as recorded in the original e-mail messages.

### **Friday, March 4, 2005:**

Arrived OPL at 12:07 pm, March 4, 2005

#### **Test Article #1:**

- All test specimens except the junction box had Hemyc wrap loosely held in place with stainless steel bands, apparently previous work was simply a fit-check of the conduit pads. No joint collars had been installed yet. Test specimens 1C & 1F overlap joints were formed from the basic conduit pads.
- I noticed that the height of the Hemyc wrap extending above the test deck at one vertical leg each for test specimens 1C and 1D were less than the 6-inch minimum specified in the Test Plan. Later, when I spoke to Mike Jordan about this he told me that an additional collar would be attached to the existing Hemyc above the test deck at these locations. I agreed.
- I also noticed that the junction box (Test Specimen 2G) for Test #2 was attached directly on its support structure. I mentioned this discrepancy to Mike Jordan, PCI Promatec, and Cleda Patton, OPL. I told them that the intent was to have the junction box framed for the air gap on all sides, including the bottom. Cleda had one of the OPL techs dismount the junction box from the support structure and raise it by ~2 inches so the framing can be installed all around it. Cutting of the junction box-support welds began at ~1:15 pm and was completed ~1:45 pm.
- The B-Line trays we ordered and 24-inch vertical bends arrived at OPL ~2:45.
- Work that was accomplished since I had arrived included the tightening of all the stainless steel bands on the Test #1 Test Specimens, except the junction box.
- At ~3:30 pm, Mike Jordan removed a section of the Hemyc wrap from Test Specimen 1A to remove some of the Kaowool material and re-sew the seam so that the circumferential overlap was reduced to 2-inches. It had been ~4-inches prior to this field modification. The wrap was replaced and re-banded at ~4:15 pm.
- The Hemyc pads (two of them) were placed around the junction box and loosely held in place with three stainless steel bands. These bands will be removed after the joints of the separate pads are sewn together around the junction box.
- The 6-inch wide collars were installed around the joints of Test Specimens 1A, 1B, 1D and 1E. The collars were then secured in place using stainless steel bands.
- All of the Hemyc installation work I witnessed today was being done by Mike Jordan and a craftsman named Frank (not me).
- Mike Jordan and I talked about the collars having a circumferential overlap of ~4-inches (end-over-end overlap, not overlap of the underlying butt joints) for the collars on both 4-inch conduit test specimens. This is something we did not specify in the Test Plan. He and I agreed that the 4-inch overlap would be acceptable as long as the overlapped regions did not cover the thermocouple locations on the conduit.

- It appeared to me that the overlap joints on Test Specimens 1C& 1F needed some minor adjustments. There were some deep gaps going into the overlapped area. Mike Jordan told me that those would be taken care of tomorrow along with some other items needing attention (e.g., patches to be located on a few areas where the Refrasil outer fabric had been torn—very small tears, on the order of ~1 inch in length, and only about five such tears in number).
- Also, the miter joints at the condolet-LBs for the two 4-inch conduits still need to be sewn together.
- Mike Jordan spent the last 45-minutes we worked today beginning the sewing of the Hemyc pad seams around the junction box.

#### Test Article #2:

- Meanwhile, Mike Murphy, PCI Promatec, and another craftsman, named Jerry, worked on finishing the air gap standoff framework for Test Specimen 2D. I measured the standoff distance from the top, sides and bottom of the cable tray and noted that the air gap distance will be in the 2 ¼ to 2 ½ inch range. I noted in the Test Plan (Rev. K) that we only specify a minimum air gap dimension of 2-inches. I decided that the standoff distances I measured were adequate and acceptable.
- I had noticed that all of the cable trays for Test Article #2 had been replaced and the thermocouples had been re-installed prior to my arrival.
- The framework for Test Specimen 2D was completed at ~5 pm this afternoon. Work immediately began on creating the framework for Test Specimen 2B.

#### Miscellaneous:

- During all of this work activity, I noticed Clea Patton taking several pictures and some video of the fabrication and installation processes.
- We stopped work today at 6:30 pm. We will begin again at 7 am tomorrow morning.
- The following information is provided for future reference:
  - Test Specimen 1A = Empty 4-inch conduit with 6-inch collar joints included in Test #1
  - Test Specimen 1B = Loaded 4-inch conduit with 6-inch collar joints included in Test #1
  - Test Specimen 1C = Empty 2 ½-inch conduit with 2-inch overlap joints included in Test #1
  - Test Specimen 1D = Loaded 2 ½-inch conduit with 6-inch collar joints included in Test #1
  - Test Specimen 1E = Empty 1-inch conduit with 6-inch collar joints included in Test #1
  - Test Specimen 1F = Empty 1-inch conduit with 2-inch overlap joints included in Test #1
  - Test Specimen 1G = Partially covered Unistrut support structure included in Test #1
  - Test Specimen 1H = Partially covered 2" X 2" tube steel support structure included in Test #1
  - Test Specimen 1I = Junction box included in Test #1
  - Test Specimen 2A = 12-inch cable tray, direct Hemyc attachment, included in Test #2
  - Test Specimen 2B = 12-inch cable tray, framed for air gap, included in Test #2
  - Test Specimen 2C = 36-inch cable tray, direct Hemyc attachment, included in Test #2
  - Test Specimen 2D = 36-inch cable tray, framed for air gap, included in Test #2
  - Test Specimen 2E = Cable drop loop, direct Hemyc attachment, included in Test #2
  - Test Specimen 2F = Cable drop loop, framed for air gap, included in Test #2
  - Test Specimen 2G = Junction box, framed for air gap, included in Test #2

## **Saturday, March 5, 2005:**

Arrived OPL at 7:00 am, March 5, 2005

### **Test Article #1:**

- I was told today that only coverings for two of the junction box supports were fabricated. A fit check of one showed that the covering was suitable and it was secured in place. Mike Jordan used the other support covering as a guide to fabricate two additional support coverings. He cut the Kaowool and silica outer fabric, and stitched the pads together by hand. This took him most of the morning to complete. When he was finished, he and Frank Haese installed the three remaining junction box support coverings and secured them in place.
- While Mike Jordan was working on the support coverings, Frank Haese completed stitching the seams between the pads covering the junction box.
- Frank then went on to stitch the seams for the miter joint at the condolet-LB for Test Specimen 1B. Afterwards, he began sewing patches over the tears in the outer fabric as noted yesterday.
- I saw that the under-wrap pad on 1I did not have any darts through its face as did the over-wrap. I pointed this out to Mike Jordan. When he was finished installing the junction box support covers, he was able to stitch some darts into the under-wrap while it was in place. (These darts are important in order to keep the Kaowool filler material from sagging down inside the outer covering.)
- Mike Jordan then began stitching the seams between the junction box support coverings and the Hemyc wrap around the junction box. He was able to complete only one of these seams before we quit for the day. Cleda will have Frank Haese finish this work on Monday.
- Hemyc wrap extension pieces were installed above the test deck on Test Specimens 1C and 1D to provide the minimum 6-inch extension as specified in the Test Plan.

### **Test Article #2:**

- Meanwhile, Mike Murphy took measurements of the Test #2 raceways in order to define the Hemyc pad dimensions for the fabrication shop. He will provide this information to the fabrication shop on Monday.
- Jerry continued working on framing Test Specimen 2B. Only two stud rails had not yet been installed on the straight vertical section when we quit for the day. Mike Murphy said they would not take very long to install when they return.
- Mike Murphy and I discussed the best way to limit sagging of the top blanket into the tray for Test Specimen 2C. We decided to use a few strips of 3M filament tape wrapped across the tray from side-rail to side-rail on 18-inch centers along the horizontal span. We felt that the filament tape would be best since it will not add any mass to the test specimen.
- Mike Murphy and I also discussed his plan for framing and wrapping the junction box and supports. The framework will also be installed on the junction box upon their return.

### **Miscellaneous:**

- During all of this work activity, Cleda Patton, OPL, took several pictures and some video of the fabrication and installation processes.
- We stopped work today at 6:15 pm. We will begin again Monday morning.
- Mike Jordan and Mike Murphy expect to return on Thursday with the Hemyc pads for the Test #2 components to finish the framework and begin insulating the cable trays.

## **Monday March 7, 2005**

Arrived OPL at 7:50 am, March 7, 2005

### Test Article #1:

- Only finishing work was done today. This included
  - Completion of stitching the support coverings to the junction box cover.
  - Adding darts to two of the new junction box support coverings.
  - Stuffing the end of the Unistrut support structure (Test Specimen 1G) with Kaowool.
  - Adding additional bands on two of the junction box support coverings where the separation distance between adjacent bands exceeded 9-inches and around the miter joints at the condolet-LB corners for 1B, 1C, 1D, and 1E. A band was also added around the miter joint on 1G.
  - Sewing patches over tears in the outer fabric on Test Specimens 1C, 1D, 1G and 1H.
- I measured the exposed lengths of both support structure test specimens (1G & 1H). The exposed section of 1G measured 9 ½ inches and 1H was 10 inches. Apparently the Hemyc coverings compressed in such a way when they were banded to the structures that they increased in length along the exposed sections. I determined that as long as we know the exposed lengths the deviation from those specified in the Test Plan is acceptable.
- Upon completion of the finish work, Cleda Patton, OPL, and I looked over each test specimen. We found no problems with the wraps and believe all Hemyc work is complete and ready for testing.
- The first test deck will be insulated tomorrow morning.

### Test Article #2:

- No work was done on Test #2 components at OPL today. It's my understanding that the Hemyc wrap fabrication drawings were being generated at Promatec and being sent to the fabrication shop.

### Miscellaneous:

- I spoke with Randy Brown this afternoon to find out if there were any problems they had encountered. He said that they will complete the shop detail drawings tomorrow morning and then will have to work with the fabricators about labor and overtime to meet our schedule. He also said that running the second test on Monday will be very difficult, but it still may be possible. He expects it will take the fabricators at least 2-3 days to make the Test 2 pads. I told him to have the fabricators do the cable tray pads first, then the cable drop pads, and finally, the junction box pads. That is doing the simplest designs first and the more complex pads later. I also told him, that if they (Promatec) thought that the overlap pieces for Test Specimen 2F would be a problem, to just design the fabrication drawings for 6-inch collar joints for both cable drops.
- We stopped work on Test #1 today at 4:05 pm.

At this point, I would say the Test #1 will happen on Friday, March 11. It is far more uncertain that Test #2 will happen before Deg Priest leaves on travel.

## **Tuesday March 8, 2005:**

Arrived OPL at 7:55 am, March 8, 2005

### Test Article #1:

- The only work done today was insulating the bottom of the test deck. This work lasted from 9:30 am until 4:15 pm. It involved cutting 24-inch wide strips of 2-inch thick insulation, forming the insulation around the test specimens where they extend up through the test deck, and, finally, securing the insulation strips to the test deck by impaling the insulation on pins welded to the bottom of the deck. Two layers of the insulation were used. The first layer was installed from left to right, beginning at the front of the test deck and working to the back. The second layer was formed of insulation strips running front to back, starting at the left side of the test deck. (For reference, "front" is edge nearest the junction box test specimen, and "back" is the edge running parallel to the two 2 ½ inch conduit test specimens.)
- No problems were encountered during the insulation work.
- The test deck will be loaded into the furnace tomorrow morning so the thermocouples can be hooked up and the data acquisition system checked out.

### Test Article #2:

- No work was done on Test #2 components at OPL today.
- I spoke with Mike Jordan at Promatec this afternoon to find out the status of pad fabrication for Test #2. Promatec is still working on some of the drawings; they expect to be finished tonight. However, they have been sending drawings to the fabricator as they are being finished. When I asked about the chances of running the test on Monday, Mike said that they were pushing the fabricators as hard as they can, but he wasn't confident that the pads will be finished in time to install them this weekend and be ready to test on Monday.
- Given the above information, it appears very unlikely that Test #2 will take place before Deg Priest leaves on his trip Monday.

### Miscellaneous:

- Cleda Patton, OPL, took a few pictures and some video of the test deck insulation process.
- Deg Priest told me that Test #1 will begin at 9:00 am on Friday, March 11. He also notified me that because of his trip, the OPL report on Test #1 will be delayed beyond the two weeks we have requested.

**Wednesday March 9, 2005:**

Arrived OPL at 7:48 am, March 9, 2005

Test Article #1:

- I found a small tear in the overlap joint on 1F this morning. Frank Haese sewed it over. One of the stainless steel bands had come loose on that same overlap joint and was removed. The 9-inch band separation distance is still being met with the two adjacent bands.
- The complete Test #1 assembly was lifted by crane and lowered into the horizontal furnace.
- The open ends of the conduit and structural members passing through the test deck were plugged with Kaowool. All gaps found in the Hemyc wraps above the test deck were also plugged with insulation material.
- The thermocouples were connected to the data acquisition system. The checkout of the data acquisition system and thermocouples will take place tomorrow.

Test Article #2:

- No work was done on Test #2 components at OPL today.
- I spoke with Mike Jordan at Promatec this afternoon to find out the status of pad fabrication for Test #2. Promatec is still working on some of the drawings. Mike informed me that they wouldn't be ready to test on Monday. I told Mike Jordan that if that is the case, then we should go back to the original plan for testing one of the cable drops (2F) with a 2-inch overlap joint. He agreed.
- Mike Jordan said that he would be here at OPL to make a final visual check of the Test #1 Hemyc wraps tomorrow morning.
- Late today, Deg Priest told me that he will make one of his people, Mike Dey, available to operate the furnace for Test #2 while Deg is on travel.
- It is now a certainty that Test #2 will not happen next week.

Miscellaneous:

- Cleda Patton, OPL, took a few pictures and some video of test deck #1 being loaded into the furnace.
- The plan is still to run Test #1 at 9:00 am on Friday, March 11.

**Thursday, March 10, 2005:**

Test Article #1:

- Work at OPL focused on installation of Test #1 into the test furnace and checkout of the thermocouple installations. The test deck was installed, thermocouples were verified, and no anomalies were noted.

Test Article #2:

- Work on the layout drawings for the pads for Test #2 continued at Promatec.

**Friday March 11, 2005:**

Test Article #1:

- Test article number 1 was conducted including both the furnace exposure and post-fire hose test. See discussion of test results.

Test Article #2:

- Mike Jordan and Frank Haese worked on framing the standoffs around the junction box (2G).



**Monday, March 14 – Thursday March 17, 2005**

Test Article #2:

- Most of the work during this period focused on the final design and construction of the Hemyc pads for Test Article #2 at Promatec. Bruce Levin, SNL, traveled to OPL on March 18 to observe preliminary installation activities at the OPL site. His observations were communicated to F. Wyant on Friday March 18 and are reported below.

**Friday, March 18, 2005:**

Test Article #2:

- I just heard from Bruce Levin, SNL, who is at OPL observing the installation of the Hemyc on the Test #2 components. He informed me that Test Specimen 2F (the cable drop framed for air gap) has been wrapped and banded. Promatec is currently working on cutting some strips of calcium silicate board and installing them between the junction box and its supports to help thermally isolate the box from the supports.
- Bruce says that Promatec has not gotten enough fabricated material yet to work on Saturday. They expect to pick up any pads that have been finished by the end of Saturday and install them on Sunday. OPL is aware of this and will be available to let them in the building and take photos and video on Sunday.

**Monday, March 21, 2005:**

Arrived OPL at 1:15 am

Test Article #2:

- Promatec worked all day yesterday, March 20. All pads have been fabricated and delivered on site at OPL.
- Test Specimen 2C (36-inch cable tray, direct wrap) was completed on Sunday.
- Test Specimen 2A (12-inch cable tray, direct wrap) was half completed on Sunday.
- Test Specimen 2E (cable drop, direct wrap) was completed on Sunday.
- Today, the horizontal supports for the junction box (Test Specimen 2G) were wrapped in 2-inch thick Kaowool and taped in place. The Hemyc pad, covering the sides and bottom of the JB were put on the junction box and held in place with tape. The partially wrapped box is sitting on the Kaowool covering the horizontal supports. There will now be no need to install calcium silicate strips between the JB and supports to thermally isolate the box.
- Today, Test Specimens 2D and 2B were both completed.
- Tomorrow, the plan is to complete the Hemyc installation on 2A and 2G.
- Work ended at ~6:00 pm today.

Miscellaneous:

- Cleda Patton, OPL, took a number of pictures and video of the Hemyc installation on the Test #2 specimens.
- With the progress being made yesterday and today, it now appears that Test Article #2 will be ready for testing on Friday, March 25.

## Tuesday, March 22, 2005:

Arrived OPL at 7:50 am

### Test Article #2:

- Promatec installed the top cover on the junction box (Test Specimen 2G). The two cover pads were stitched together and metal bands were strapped around the box to help hold the pads in place.
- Test Specimen 2A (12-inch cable tray, direct wrap) was completed and banded.
- Two suspension bands were added to each of Test Specimens 2E and 2F to support them at their mid-point horizontal joints. These additional suspensions, attached to the metal test deck, were needed to prevent excessive gapping of the joint covers (collar or overlap) due to the natural sagging of free-hung cable drops.
- Three additional impaling studs were installed on the framework at the bottom of Test Specimen 2D in order to provide additional support to the bottom Hemyc pad overlap. Prior to this change, the outer overlap pad on the bottom of the tray was sagging to the point that a significant opening to the interior of the wrap was evident. The Hemyc wraps were attached to the impaling studs in a manner like that used on the other portions of the framework using fender washers and lock nuts.
- A broken impaling stud was noticed at the very top of the vertical leg (above the test deck) on the outside rail of Test Specimen 2D. I made the decision to band the Hemyc in place at that location instead of trying to weld a new impaling stud. The banding will adequately support the Hemyc and keep it from trying to separate when the space above the test deck is stuffed with insulation later.
- I noted that there were no vertical joints on either of the two cable drops. I talked to Mike Jordan, PCI Promatec, about this. He suggested that he could easily modify Test Specimen 2E to create a butt-and-collar joint at the desired location on one of the vertical legs. However, Promatec would have to have two additional pads made to provide the 2-inch overlap joint specified for Test Specimen 2F. In the interest of staying on schedule, I asked Mike Jordan to only modify 2E per his recommendation, but to leave 2F as is (i.e., only one 2-inch overlap joint at the mid-point of the horizontal span, and no additional overlap joints). He agreed and completed the modification of 2E this afternoon.
- Several additional bands were added to Test Specimen 2C to close up a number of visible gaps in the Hemyc wrap.
- A number of visible gaps were stitched closed in Test Specimens 2B and 2D. This work was completed on 2B, but about 18-inches of stitching remains to be done on 2D.
- Several patches and sewing repairs were made to Test Specimens 2D, 2E, 2F and 2G.
- Tomorrow, we plan to complete seam stitching on 2D and to insulate the supports for 2G using Kaowool wrap (not Hemyc). The box is doubly insulated from the supports now, but the supports need to be insulated in some way to limit thermal loss from the furnace through the top of the test deck. Plain Kaowool wraps appeared to be the simplest and quickest method to accomplish this goal. The wrapped junction box will then be secured to the insulated supports using additional banding to provide it sufficient stability during movement of the test deck. Following the completion of all this, we plan to turn the test assembly over to OPL for insulation of the test deck.
- Work ended at ~5:30 pm today.

### Miscellaneous:

- Cleda Patton, OPL, took a number of pictures and video of the today's work on the Test #2 specimens.
- Given our progress today, it still appears that Test Article #2 will be ready for testing on Friday, March 25.

**Wednesday, March 23, 2005:**

Arrived OPL at 7:45 am

Test Article #2:

- Promatec finished the seam stitching required on 2D and insulated the supports for 2G using 2-inch thick Kaowool wraps. They then secured the upper portion of the junction box to the supports using metal bands.
- Chuck Girard, URS, arrived this afternoon to see the test assembly. He'll stay through the test on Friday.
- The test assembly was turned over to OPL to install the 4-inch test deck insulation. The insulation was completed this afternoon.
- The completed test deck will be installed into the furnace tomorrow morning and the process of connecting the thermocouples will begin. We still plan on running Test #2 early on Friday, March 25.
- Work ended at ~4:30 pm today.

Miscellaneous:

- Cleda Patton, OPL, took a number of pictures and video of the today's work on the Test #2 assembly.

**Thursday, March 24, 2005:**

Arrived OPL at 8:00 am

Test Article #2:

- Test Deck #2 was installed in the furnace without incident.
- All 335 thermocouples were connected to the data acquisition system and checked.
- Test #2 will be run at ~9:00 am on Friday, March 25.
- Left OPL at ~3:45 pm today.

Miscellaneous:

- Cleda Patton, OPL, took a number of pictures and video of the movement of Test #2 assembly into the furnace.
- Test deck #3 was moved into the location where test deck #2 had been during assembly and Hemyc installation. Test deck #1 was moved to the location where test deck #3 had been previously.

**Friday, March 25, 2005**

Arrived OPL at 7:47 am

Test Article #2:

- OPL, Promatec, NRC and SNL performed a final inspection of all test articles prior to the test furnace being closed. Two metal bands were found to be loose: one on 2A and one on 2C. Both metal bands were replaced.
- Test number 2 was conducted including both the furnace exposure and post-fire hose test. See discussion of test results.